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A Design and Development of a Building Environment 3D-Walkthrough

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Abstract - This paper reports an ongoing study that uses 3D walkthrough as an alternative promotional platform. A user centered design methodology was adopted. The design and development process that combines the integration of 3D virtual environment and multimedia development is the focus. A pilot study with experts in 3D and multimedia was done. Result shows a positive feedback.

Index Terms- 3D walkthrough, animation, design and development

1 Introduction

3D walkthrough can be used to show some areas or introducing view spots. Most of the video walkthrough uses 3D objects to create the environment and it is hard for the walkthrough video to be operated in real time interaction. However, in some situation real time walkthrough is important. The meaning of real time interaction is where users can navigate or control the video.

The use of 3D model, virtual reality, virtual environment, animation, and multimedia technology has been widely employed to simulate and visualize real environment. For example, they have been use as a simulation for construction promotion [1], virtual Hajj application by Yusoff, Zulkifli, & Faisal Mohamed (2016), a real-time interactive architectural visualization [3], tourism application [4], and for plantation management [5].

Looking at the success of these products, this study aims to develop a 3D walkthrough animation that employs the earlier concept as a promotion material for the School of Multimedia Technology and Communication (SMMTC).

This paper is structured as follows. The introduction discusses the background and issues that motivate this study. Next, the design and development process is explained followed by the result and discussion.

2 Design and Development of 3D Walkthrough

This study adapted the user-centered development (UCD) methodology [6] consisting of analysis, design, prototype, and measure phases. In UCD method, every phase is centered on users and is highly iterative, in which the client and representative users were consulted in every phase. Fig. 1 illustrates the four phases in UCD methodology.

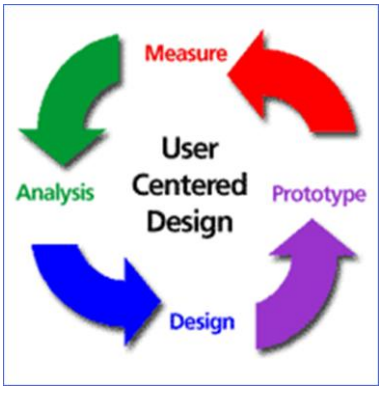

Fig. 1 The User-Centered Development Methodology

First, in the analysis phase, existing problems and issues were identified. Then, few possible solutions were brainstormed and discussed with the client and representatives of user. Requirement gathering process was also conducted. The client and users of the prototype were interviewed for their concerns and requirements. User requirements and functional requirements were identified and presented to the client for endorsement.

The agreed requirements were then translated into a storyboard – the design of the prototype to illustrate the user interface, concept, and flow of the prototype. This process was iterated a few times until the final design was approved and verified by the client.

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Next, the development phase that focused on the 3D and multimedia development phases began. A development process, as illustrated in Fig. 1, proposed by Yusoff, Zulkifli, & Faisal Mohamed [2] were adapted.

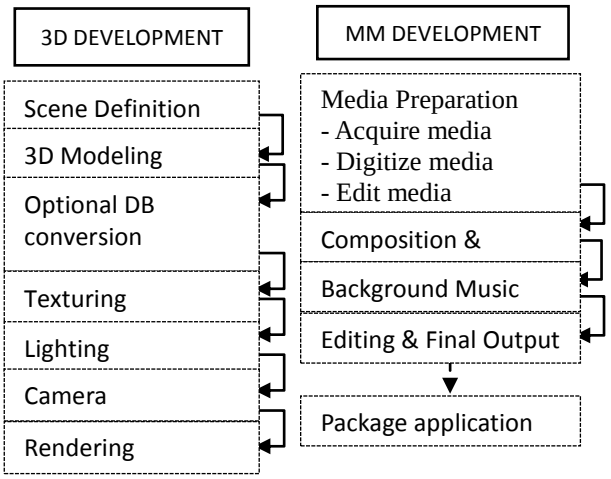

Fig. 1 The Development Process

2.1 3D Development Process

The 3D development process was very challenging but interesting. Six main activities were involved.

Scene Definition. The scene definition process ensures the entire specification – the scene or environment - for the prototype was properly set before modelling an object. Photos of the locations identified for the prototype was taken to aid the design and modelling process. The overall environment were then sketched into a storyboard and shown to the client for verification.

3D Modeling. 3D modeling is a process of taking a shape and molding it into a completed 3D view. The object modelling involves geometric modelling where the shape of the object is represented. Many 3D object and 3D modelling software are available today such as Autodesk 3Ds Max, Blender, and Google Sketchup. 3Ds Max were used in this project. Object type such as wall, box, cylinder, rectangle, and spline shape were used in modelling objects involved. Boolean operation was also used to modify the objects.

Fig. 3 and Fig. 4 show two examples of object modeling for two meeting rooms.

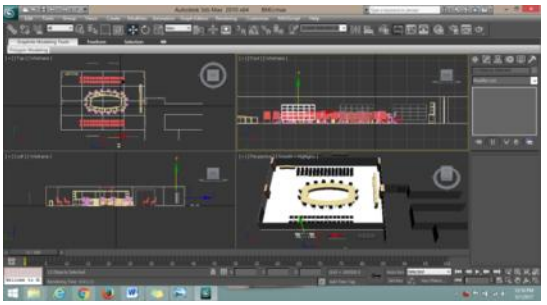

Fig. 2 Object Modeling for a small Meeting Room

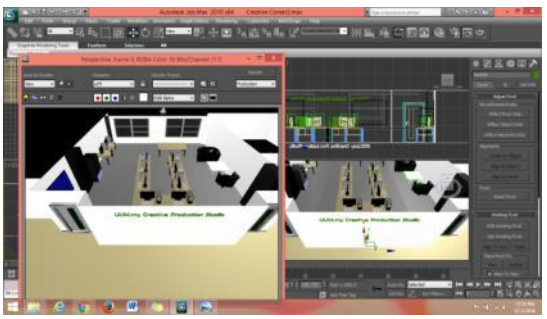

Fig. 3 Object Modelling For Main Meeting Room

Optional Database Conversion. This optional process was done to minimize the file size in 3Ds Max to speed up the rendering process. In every scene, the use of lighting, shadows were reduced and unnecessary objects were deleted. This will save time during rendering process.

Texturing. Texturing is the process to make the object become more realistic that suits the environments needs. It is a process where a 2D surface is wrapped into a 3D object [7]. There are three processes related during texturing the object: acquire media, digitize media and edit media. Acquire media covers all the suitable texture based on the picture. Similar texture likes the real object were identified. Next, digitize media is a process where all the material need to be converted into digital forms. For example, images were scanned and converted into suitable format such as bitmap. Edit media is a process of altering the image. For this study, Adobe Photoshop CS6 and Adobe Illustrator CS6 were used to edit the image.

Lighting. Lighting is the process to make 3D scenes come alive. Lights in 3D are designed to simulate how lighting works in real life. For this project, three types of lighting such as skylight, Omni light, and Mr Area Omni light were used because they give different effects appropriate with the size of area and the environment.

Skylight simulates outdoor lighting and shines in all direction, Omni light shines in all direction and Mr Area Omni light is suitable for a small area. To ensure that the environment is neither too dark nor too bright and that the effects of shadows are suitable with the environment, the intensity and parameter shadows were controlled.

Camera Setting and Animation. This process transforms scenes into an animation. Two types of camera movement were used for every scene, which are panning and walkthrough camera.

Rendering. Rendering is the last process in 3D development. Before rendering, a range of time output, resolution, and format for the video were set. An average time to complete one scene takes 900 frames that equals to 27 seconds. To save time, for a specified resolution of 1280 x 720 pixels, the range of time output was set to at least 300 frames. Then, the rendering process converted the file format from .max to .avi. Fig. 4 and Fig. 5 show the rendering setting and the rendering process in 3Ds Max respectively.

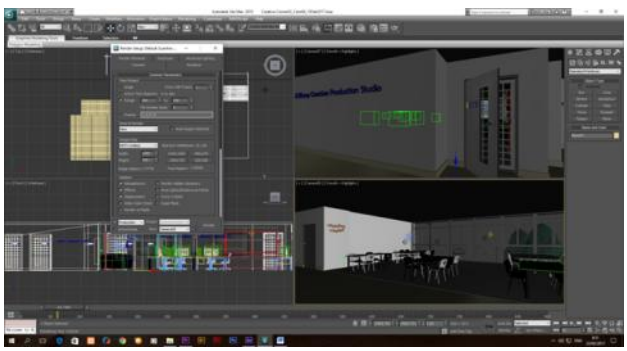

Fig. 4 Rendering setting

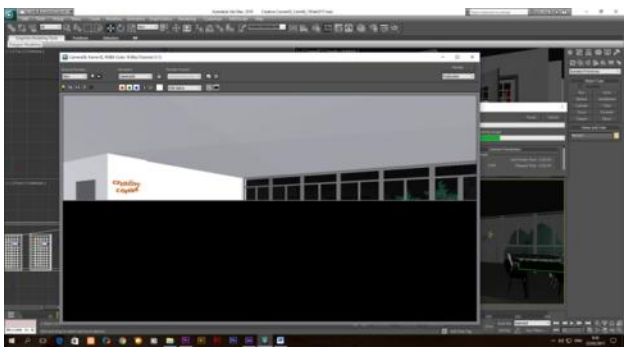

Fig. 5 Rendering Process

2.2 Multimedia Development

In multimedia development process, three main tasks were involved.

Composition and Special Visual Effects. In composition and special visual effects process, the output of video rendered from 3Ds Max were brought into Adobe Premiere before adding special effects in Adobe After Effect. All videos rendered in 3Ds Max were combined in Adobe Premiere. Then, the video were imported into Adobe After Effect to add the lower third a title for every place.

Adding Background Music. Background music was added to give some feel of enjoyment to the video. During this process, the client has requested for upbeat background music. A few samples of background music that meet the requirement were prepared. Next, the process of selecting the background music was done with the client and users.

Editing and Final Output. The last process is editing the final output. This process involved editing the opening of the video, logo of the client, slideshow of photo, and the ending of the video in Adobe After Effect. To come out with the final output, all scenes were combined using Adobe Premiere.

2.3 Measure

To test the usability in terms of satisfaction and ease of use of the SMMTC 3D Walkthrough as an alternative promotion platform to introduce SMMTC, evaluations should be conducted. Ideally, for UCD evaluation, evaluation should be done through usability with real users [8]. However, this study has only undergone an expert review pilot test.

Two experts in virtual environment and multimedia filed together with the client were involved in the test. The test took place in a discussion room. The experts and client were shown the prototype and let to explore it and asked to give feedback on the usability and satisfaction of the 3D Walkthrough. The session took around an hour. Fig. 7 and Fig. 8 show screenshots of the 3D Walkthrough result.

Fig. 7 View of SMMTC foyer in the prototype

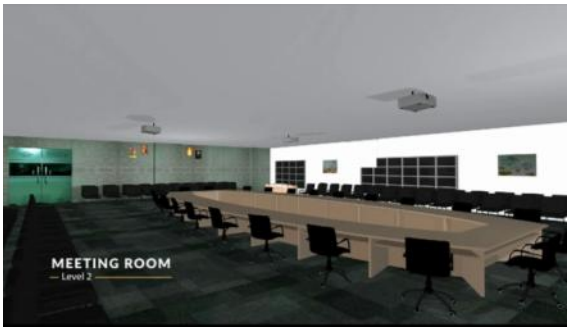

Fig. 8 Result of the main Meeting Room

The expert review revealed that experts are satisfied with the quality of most venue highlighted such as the foyer, the main meeting room, and the main office. They suggested that more details like paintings, windows, and lighting should be added to make the places look more real. However, they are not happy with visualization of few other places such as the pantry and the student corner as they lack details. Expert also commented and requested that interactivity of the prototype should be improved as it would make the whole user experience better.

Result shows that the output was satisfactory but there were still avenue for improvements. Interactivity was the major concern as the prototype did not provide full-fledge interactivity. Having the prototype completed and considering that the interactivity can be improved, the client has requested for the prototype to cover other areas of SMMTC.

3 CONCLUSION

This paper discussed the design and development of a 3D walkthrough for SMMTC. The methodology related to developing the walkthrough were presented focusing on the design and development phase. A pilot study conducted shows a promise to the success of a 3D walkthrough as an alternative tool of promoting SMMTC.

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